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HUMAN EXTINCTION

A HISTORY OF THE SCIENCE AND ETHICS OF ANNIHILATION

Émile P. Torres

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Although accessible enough to be read by undergraduates, *Human Extinction* contains new and thought-provoking research that will benefit even established academic philosophers and historians.

Émile P. Torres is a philosopher whose research focuses on existential threats to civilization and humanity. They have published widely in the popular press and scholarly journals, with articles appearing in the *Washington Post, Aeon, Bulletin of the Atomic Scientists, Metaphilosophy, Inquiry, Erkenntnis*, and *Futures*.

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Human Extinction

A History of the Science and Ethics of Annihilation

Émile P. Torres

Routledge
Taylor & Francis Group
NEW YORK AND LONDON

First published 2024
by Routledge
605 Third Avenue, New York, NY 10158

and by Routledge
4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

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Library of Congress Cataloging-in-Publication Data
Names: Torres, Émile P., author.
Title: Human extinction : a history of the science and ethics of annihilation / Émile P. Torres.
Description: New York, NY : Routledge, 2023. | Series: Routledge studies in the history of science, technology, and medicine | Includes bibliographical references and index. | Contents: An apocalypse without kingdom—Beginnings of "the end"—'Till entropy death do us part—The invention of omnicide—Mother nature wants to kill us—The perfection of evil—What is human extinction?—Early ruminations—Ethical innovations of the postwar era—Astronomical value and the harm of existence—Recent developments—Looking forward to the future.
Identifiers: LCCN 2022061817 (print) | LCCN 2022061818 (ebook) | ISBN 9781032159065 (hardback) | ISBN 9781032159089 (paperback) | ISBN 9781003246251 (ebook)
Subjects: LCSH: Human beings—Extinction—Research—History. | Human ecology—Research—History.
Classification: LCC QH78 .T677 2023 (print) | LCC QH78 (ebook) | DDC 576.8/4—dc23/eng/20230405
LC record available at https://lccn.loc.gov/2022061817
LC ebook record available at https://lccn.loc.gov/2022061818

ISBN: 978-1-032-15906-5 (hbk)
ISBN: 978-1-032-15908-9 (pbk)
ISBN: 978-1-003-24625-1 (ebk)

DOI: 10.4324/9781003246251

Typeset in Bembo
by Apex CoVantage, LLC

Dedicated to the curious little scientists Lucy and Zach, my niece and nephew, whom I love more than anything.

Also dedicated to Brian Deebel and three other acquaintances who have tragically passed on. So long as I am living, you will not die a "second death."

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Preface and Acknowledgments

This is a long book that hardly scratches the surface of its subject: human extinction. I examine the origins and evolution of this idea from a primarily Western perspective and hence neglect entire universes of thought from other regions of the world, and from other (for example, Indigenous) points of view. Yet even from this Western perspective, my limitations as a historian and philosopher will no doubt frustrate those with expertise on particular historical and philosophical ideas. Despite these shortcomings, I hope this book outlines a useful and perhaps compelling theoretical framework for thinking about how our understanding of humanity's existential predicament has changed over time, and how Western intellectuals have thought about the normative issues surrounding the possibility of our species' disappearance. Given the breadth of this work, there should be something of interest to people in many different fields: philosophers may learn something about history and science; scientists may learn something about philosophy and history; and historians may learn something about science and philosophy. At the very least, I hope this book encourages people to take seriously the large-scale threats to our continued existence and collective wellbeing that now confront us. Tentatively, my plan is to follow this up with one or more subsequent publications exploring the same topic from non-Western perspectives. The present work may thus be seen as the first volume of a larger project.

The main themes of this book will make the most sense—unsurprisingly—if one reads it entirely and in order. However, Part I and Part II are modular to an extent, meaning that they could be understood somewhat independently of each other. To those primarily interested in how thinking about the ethical and evaluative implications of our extinction developed over time, I recommend reading Chapter 1 for an overview, which may be sufficient to make sense of Part II. On the flip side, what one makes of the particular "existential mood" that defines our current moment will depend in part on one's views about the ethical aspects of our disappearance, and hence one's reading of Part I may be enriched by Part II. The two halves can be decoupled, in other words, but are best thought of as a marriage of overlapping and interacting narratives.

I am deeply grateful for feedback from and conversations with many extraordinary people over the past four years. The list includes Fred Adams, Peter Bowler, Gerry Canavan, Lewis Coyne, Oswaldo Chinchilla, Zoe Cremer, Roger Crisp, James Dator, Jason Dawsey, Paul Ehrlich, Kyle Evanoff, Debbie Felton, Elizabeth Finneron-Burns, Bennett Gilbert, Walter Glannon, Martin Glazier, Pavel Gregoric, Thomas Hornigold, Tom Hurka, Erika Juhlin, Aatu Koskensilta, Bas Leijssenaar, James Lenman, Adrienne Mayor, Theresa Morris, Thomas Moynihan, Ingo Müller, Ian Myles, Jan Narveson, Morton Paley, Michael Rampino, Toni Rønnow-Rasmussen, Chase Roycroft, Bart Schultz, Will Steffen, Stephen Self, Susan Schneider (who secured an office for me at the United States Library of Congress on two occasions, during which I wrote drafts of this manuscript), Christian Tornau, and Robert Wicks, as well as the Centre for the Study of Existential Risk (CSER), which hosted me for several months in 2019, when the idea for this project was born. Special thanks to Frances Flannery for helping me understand early Christian beliefs, Spencer Weart for insightful feedback on Part I, Luke Kemp for comments on an early draft that significantly influenced how I rewrote the book, Simon Knutsson and S. J. Beard for many incisive comments on Part II, and Mathias Frisch at Leibniz Universität Hannover and Ralph Stoecker at Universität Bielefeld for supervising my Ph.D. dissertation, which is largely coextensive with this book. I am most indebted to Daniel Deudney and Dan Zimmer for extensive, detailed comments on and criticisms of early and later drafts. Dan Zimmer, in particular, helped with edits right up to when a final draft was submitted. I cannot express in words my appreciation to everyone above: thank you.

Finally, thanks to my father John Paul, sister Sylvia, and brother-in-law Chris for supporting me when I was jobless and giving me a home when I had nowhere to stay. Compassion is the glue that holds the world together—without it, there would be only isolation and despair. Through laughter and tragedy, the ups and the downs, good people are there for each other.

I take full responsibility for all errata, which I will catalogue here: www.xriskology.com/book-errata.

1 An Apocalypse Without Kingdom

Too Much Algae

"Oh yes, that could happen," Malcolm declared. "A meteor could strike Earth. Climate change could destroy all plant life, causing animals and humans to starve to death. And if we catch too many fish, there will be too much algae filling up the ocean, and without water, we die."[1]

If some of this sounds implausible, there is a good reason: Malcolm is a seven-year-old Swedish boy responding to a question posed by a colleague of mine, at my behest: "Could humanity go extinct like the dinosaurs or dodo?" I had initially posted this on social media, asking friends if they would be willing to query their children about it and relay the answers given. Several replied, and in every case the answer was "Yes, our extinction is possible," often followed by some imaginative account of how this might happen. The most common means of annihilation involved asteroid strikes, although other children mentioned climate change and evil robots. One clever child even huffed back at her parent that my question was confusing since only the *non-avian* dinosaurs perished 66 million years ago. The *avian* dinosaurs, which descended from the Theropoda clade that boasts of charismatic reptiles like *T. rex* and the velociraptor, survive among us as modern-day birds. In fact, she was right to object, and so I must apologize for not being clearer!

The point of this evidence gathering via anecdotal survey was to get a sense of how commonplace the concept or idea of *human extinction* is today.[2] Although no large-scale surveys have yet been conducted on the topic, I suspect that most people in the West nowadays would acknowledge that our extinction is at least *possible*.[3] If this is correct, it points to an extraordinary fact, since for much of Western history the concept of human extinction would have struck nearly everyone as (P1) unintelligible, incoherent, or self-contradictory, not unlike the concepts of *married bachelor* and *circles with corners*, and (P2) denoting an outcome that could *not possibly obtain*, just as there are no married bachelors or circles with corners. These phenomena are related but distinct: a concept might be unintelligible to some people but still denote a real possibility in the world, and there are many impossible outcomes that are nonetheless intelligible, such as pigs flying, which we can easily imagine despite pigs lacking the ability to take flight. The idea of our

DOI: 10.4324/9781003246251-1

extinction, though, wouldn't have made sense if people in the past had considered it, and just about everyone would have claimed that it could never happen. As Malcolm shows, this is no longer the case. What changed?

To better answer this question, it will help to first outline a preliminary account of the idea of *human extinction* so that we know what we are talking about. For now, let's define human extinction as having occurred if there are no more tokens of the type "humanity" in the world. A token is the instantiation of a type, and hence this definition states that if there are no living members of *Homo sapiens* at some point in the future, then *Homo sapiens* will have gone extinct. This is intended to be a *naturalistic* definition, one that precludes humanity from "living on" in an afterlife of some sort; it is the kind of extinction that the dinosaurs and dodos underwent—they existed and now they don't. Notice right away that this contrasts with religious conceptions of humanity's future. On these accounts, the end of the world is not the end of our story but, in a profound sense, the *beginning*. Religious views anticipate a future *transformation*, whereas naturalistic extinction entails our complete *termination*. As the German philosopher Günther Anders wrote in 1959, extinction would be "a naked apocalypse," an "apocalypse without Kingdom."[4]

One of the main contentions of this book is that for approximately 1,500 years, between the fourth and fifth centuries of the Common Era (CE) and the nineteenth century, the idea of *human extinction* was almost entirely "blocked," as I will say, from the minds of most people in the West. This differs in important ways from other conclusions defended in the nascent literature on human extinction, which as of this writing consists of only a handful of books and articles.[5] For example, the Oxford historian Thomas Moynihan argues in an article for *Aeon* that "as ideas go, human extinction is a comparatively new one," having "emerged first during the 18th and 19th centuries."[6] I disagree: the idea that humanity could disappear from the universe entirely—in other words, go extinct as defined above—turns out to have been entertained by ancient Greek philosophers and gestured at by mythological systems of even earlier provenance. There are, indeed, ample references to human extinction in the ancient world, as when the Akkadian epic poem of *Atrahasis*, which dates back to the eighteenth century BCE, describes one god attempting to completely annihilate humanity, or when the Presocratic philosopher Xenophanes posited one stage of cosmic evolution as entailing the elimination of all human life on Earth. To oversimplify somewhat, I will argue that the idea of human extinction first made an appearance before the Common Era, was subsequently blocked during the roughly 1,500-year period specified above, reemerged in the nineteenth century (especially the second half), and has since steadily grown in prominence up to the present.

By "prominence," I mean the extent to which the idea is salient on the cultural landscape. A proxy measure of prominence can be obtained using the Google Ngram Viewer, which its creators describe as enabling "scholars to make powerful

Figure 1.1 Google Ngram Viewer results for the keyword "human extinction."

inferences about trends in human thought" by combing through Google's text corpora of roughly 8 million digitized books (see Figure 1.1).[7] Although 8 million books amounts to only about 6 percent of all the books published between 1500 and 2019, this is currently the best tool available for understanding the salience of ideas along a diachronic dimension, and I will rely on it now and then to buttress certain conclusions of mine. In sum, human extinction is an old idea, but it disappeared from sight for much of Western history, only to reappear more recently—though not so much in the eighteenth century as in the one that followed.

The Great Chain, Personal Death, and the End of the World

This leads to the question of *why* the idea of human extinction was blocked for so long. The answer concerns two clusters of beliefs that became central to Christianity around the fourth or fifth centuries CE, each of which was sufficient to render our extinction unthinkable.[8] I have separated these into clusters according to which concept in *human extinction* they target. That is to say, *human extinction* consists of two concepts—*human* and *extinction*—and hence my claim is that one cluster of beliefs specifically concerns the first concept, while the other concerns the second. Let's take a closer look at this:

To understand why extinction seemed unthinkable, we must begin with the Great Chain of Being, a model of reality whereby all things, living and nonliving, are ordered in a linear and immutable hierarchy. First articulated by the Neoplatonists in the third century CE, it became enormously influential within the West after Christian writers like Saint Augustine (354–430 CE) incorporated it into the Christian tradition. The Great Chain asserts that there are no gaps in nature: everything that *can* exist *does* exist, now and forever. This is just the fundamental structure of reality, however odd it may strike contemporary readers. It follows that since no links in the chain can ever go missing, extinction of any sort is impossible, which means that our own extinction is

impossible as well. In other words, by precluding the disappearance of *any kind* of thing in the universe, the Great Chain implies that we, too, can never disappear. As we will see, this model of reality collapsed in the early nineteenth century, which thus removed one major barrier to imagining our collective demise.

The second cluster of beliefs concerns the essential *nature* of humanity and our unique *role* in the unfolding of God's grand plan for the world. Most Christians since the middle of the first millennium have accepted a dualistic anthropology according to which human beings are composed of both material and immaterial parts: a body and a soul. The soul is immortal, although at the end of time it will be reunited with a physical resurrection body, which will also be immortal. This has been the standard Christian view of what is called "personal eschatology," which concerns our fate as individuals rather than the cosmos as a whole. Importantly, it yields a second reason that human extinction cannot occur: since each individual human is immortal, and since humanity is just the sum total of all humans, it follows that humanity itself is immortal. Let's call this the *ontological thesis*, since it concerns the ontological status of human beings as body-soul composites that, once created by God, will never cease to exist. It also explains why the concept of *human extinction* would have struck many as incoherent or self-contradictory: contained within the idea of *human* is the idea of *immortality*, since to be human is to be immortal. Consequently, asserting that "humanity can go extinct" would be like saying "an immortal kind of thing can undergo a process that only mortal kinds of things can undergo," which is an obvious logical contradiction.[9] This is why I likened *human extinction* to concepts like *married bachelor* and *circles with corners*, as these are also self-contradictory.

In contrast, "cosmic eschatology" is about "the ultimate resolution of the entire creation," and thus concerns end-times events like the Second Coming of Christ (*Parousia*), Battle of Armageddon, Final Judgment of humanity, and creation of a new heavens and Earth.[10] An important idea here is that cosmic eschatology is ultimately about balancing the scales of justice by punishing the wicked and rewarding the righteous. In other words, it is about *theodicy*, a term coined by Gottfried Wilhelm Leibniz in the early eighteenth century to denote the problem of vindicating God given the presence of evil in the world. As the New Testament scholar Craig Hill writes about this,

> at heart, all eschatologies are responses if not quite answers to the problem of evil. . . . Eschatologies differ in how they conceptualize God's triumph, but they are essentially alike in asserting God's victory as the supreme reality against which all seemingly contrary realities are to be judged.[11]

This yields a third reason that human extinction cannot happen: since there can be no balancing of the scales of justice without humanity surviving beyond

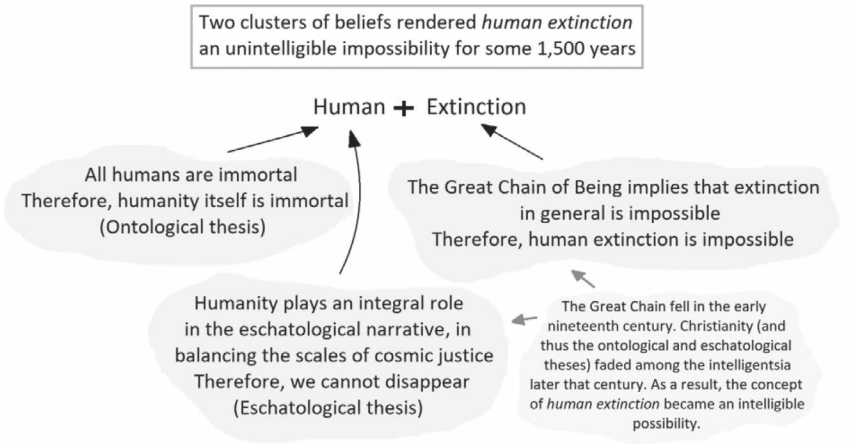
Two clusters of beliefs rendered *human extinction* an unintelligible impossibility for some 1,500 years
Human + Extinction
All humans are immortal
Therefore, humanity itself is immortal
(Ontological thesis)
The Great Chain of Being implies that extinction in general is impossible
Therefore, human extinction is impossible
Humanity plays an integral role in the eschatological narrative, in balancing the scales of cosmic justice
Therefore, we cannot disappear
(Eschatological thesis)
The Great Chain fell in the early nineteenth century. Christianity (and thus the ontological and eschatological theses) faded among the intelligentsia later that century. As a result, the concept of *human extinction* became an intelligible possibility.

Figure 1.2 The three beliefs that "blocked" thinking about human extinction.

the end of the world, it is inconceivable that we might cease to exist. How could God's grand plan unfold without us? How would good prevail over evil? Human extinction simply isn't on the cards for us; it just isn't the way our story ends. Let's call this the *eschatological thesis*, noting that it, like the ontological thesis, specifically concerns the idea of *human* rather than *extinction*, whereas the Great Chain makes a general claim about *extinction*.

We thus have three reasons that our extinction is fundamentally impossible: first, because it is metaphysically impossible, given the Great Chain model of reality. Second, because it is ontologically impossible, given that humanity is immortal. And third, because it is eschatologically impossible, as we are the main characters in the cosmic drama of good and evil: without us, the show cannot go on, and since the show must go on, we cannot die out.[12] Because these beliefs became central to the Christian worldview beginning in the early first millennium, the rise and fall of Christianity will be an integral part of this book's account of the origins and evolution of *human extinction* in a naturalistic sense. However, we will also see that even before Christianity took root in the West, there was nonetheless a widespread assumption that our species is indestructible, though the reasons tended to be peculiar to the various philosophical, religious, and mythological systems that people accepted at the time.

Kill Mechanisms

Yet the intelligibility of the concept of *human extinction* and the possibility of the outcome it denotes—that is, propositions (P1) and (P2) above—form only

half of the story. The other half concerns the distinct question of whether our extinction could *actually happen* in our particular world, assuming that it is possible *in principle*. That is to say, it could be that, as a matter of fact, our world contains no "kill mechanisms," which I will define as a means of elimination capable of precipitating our complete non-existence. In fact, for much of the twentieth century, the scientific community almost unanimously agreed that the universe doesn't contain any *natural* kill mechanisms that pose risks to our survival (aside from the Second Law of thermodynamics, discussed in Chapter 3). In other words, nearly everyone believed that we live on a very safe planet in a very safe universe—not on an individual level, of course, since any one of us could be eaten by lions, crushed by a falling boulder, or catapulted into the grave by a deadly virus, but on the species level: the natural world does not pose any real threats to *humanity*. This view dominated the Earth sciences from at least the 1850s until it was overturned in the 1980s and 1990s, after it became clear that the non-avian dinosaurs died out because a large asteroid struck the Yucatán Peninsula in southeastern Mexico (as the young respondent mentioned earlier is no doubt aware). The implications of this were ominous: if the dinosaurs could be annihilated by naturally occurring hazardous phenomena, then so could humanity. The point is that even if extinction is possible in principle, if there is no reason to believe it could actually happen, then there may be no particular reason to take the idea seriously.

Glancing across the horizons of history, one is struck by a dazzling array of proposed kill mechanisms. Some were associated with supernatural deities or events; others were built into the natural cycles of cosmic evolution; and still others involved idiosyncratic speculations about phenomena like comets and floods. For the purposes of our study, what matters are kill mechanisms that we could describe as "scientifically credible," that is, means of elimination that were widely accepted by the community of scientists (or natural philosophers) based on compelling empirical evidence. The first kill mechanism of this sort was the aforementioned Second Law of thermodynamics, which physicists in the mid-nineteenth century immediately recognized as posing a long-term threat to humanity: Earth will become increasingly inhospitable as the sun cools down, until the flickering flames of all forms of life are snuffed out. Since then, a whole constellation of credible kill mechanisms has been discovered and created—in the case of anthropogenic threats—and there is no good reason to believe that more won't be discovered or created in the future, as science pushes back the envelope of human ignorance and technology enhances the violence capacities of state and nonstate actors.

The Mood of the Times

The identification of kill mechanisms thus constitutes the second half of the story that spans Part I of this book. Since the collapse of the Great Chain and retreat of religion enabled the idea of human extinction to become an intelligible

possibility, let's refer to them as *enabling conditions*. And since, as we will see, the discovery, creation, and even mere anticipation of new kill mechanisms often triggered qualitatively novel understandings of our existential vulnerability in the universe, let's refer to them as *triggering factors*. These two phenomena bring us to one of the most important ideas of Part I, namely, that of an *existential mood*, which provides the organizing principle behind the periodization outlined in the first half of this book.

One way to approach the idea of an existential mood is as follows: by combining the phenomena of enabling conditions and triggering factors, one can construct an explanatory-predictive hypothesis that, I argue, accounts for the historical record of thinking about human extinction and provides insights—predictions—about how this thinking could change in the future. (The predictive aspect of this hypothesis will occupy us in Chapter 12.) What, then, does the historical record show? It shows a number of major shifts in how people thought about our existential predicament. More specifically, these shifts corresponded to different sets of answers to crucial questions like: Is our extinction possible? If so, how could it happen? How many kill mechanisms are there? Are they natural or anthropogenic? Do they pose risks in the near term or distant future? How probable is our extinction? Is this probability rising or falling? Is our extinction inevitable? And so on. Let's define an existential mood as proceeding from a *particular set of answers* to these questions, where "mood" is understood in a collective rather than individual sense, as in a "public mood" or the "mood of the times." As Erik Ringmar explains this idea, beginning with the more familiar moods had by individual people:

> To be in a certain mood . . . is to attune oneself to the situation in which one finds oneself. A mood answers a question of how we feel and thereby reports on the state of our attunement. A public mood would thereby be a question of how a public attunes itself to the situation in which it finds itself.

Public moods are something akin to an "atmosphere" that imbues society (or some segment of society), thereby "coloring everything we see around us in a certain hue." The 1950s, for example, "was allegedly characterized by a mood of optimism but also of anxiety; the 1960s by a mood of liberation, rebellion, and experimentation; the 1970s by disillusionment and lost hopes, and so on."[13]

An *existential* mood thus arises from the situation in which people find themselves given some set of epistemologically robust answers to the questions above about the possibility, probability, etc. of our extinction. The result is a general *outlook* on our collective future—on whether we will have a future—that colors everything we see right now and up ahead in a certain hue. An existential mood is an atmosphere that permeates the thoughts and

expectations of large numbers of people in the same general way, leading them to similar beliefs about where humanity is and might be going. Also relevant to my conception of an existential mood is the etymology of its second term, which derives from the Old English word *mod* meaning "heart, frame of mind; courage, arrogance, pride; power, violence," all of which capture some aspect of being "in" one existential mood or another. Of note is that there may also be an etymological connection between "mood" and "moral," as the latter comes from the Latin *mos*, meaning, in plural, "mores, customs, manners, morals."[14] For reasons hinted at below and elaborated in subsequent chapters, this too will be pertinent. As for "existential," I take its definiens to be "relating to existence" rather than "concerned with existentialism," the mid-twentieth-century cultural and philosophical movement associated with thinkers like Simone de Beauvoir and John-Paul Sartre. This sense of the word has become common today, due in part to the attention that the notion of *existential risks* has received among academics and within the popular media.

The Five Moods

Turning back to the historical record, I will argue that it reveals *five distinct* existential moods, thus yielding a five-part periodization of Western thinking about our extinction. There are several points to make about this: first, each existential mood was highly *stable* during its corresponding period of time. Second, the shifts between one to another existential mood have all been quite *abrupt*, unfolding over a matter of years or, at most, just over a decade. These transitions were in every case accompanied by figurative, and sometimes literal, gasps, as they marked fundamentally new understandings of our existential predicament in the universe. Third, once human extinction became an intelligible possibility during the nineteenth century, each shift was triggered by the discovery of one or more novel kill mechanisms, with one notable exception: the most recent shift. Fourth, given that it usually took some time for these shifts to unfold, I will distinguish between when an existential mood first *emerged* and when it fully *solidified*, at which point the mood, or outlook, became stable. And fifth, the emergence and solidification of new existential moods was in all cases, except for one, *cumulative*, that is, each built upon rather than replaced the previous existential moods; here, the metaphor of a palimpsest may be useful. The only exception was the initial shift in the 1850s, when the new existential mood *superseded* the earlier one rather than building on it, although we will see in Chapter 12 that the first existential mood could very well reappear in the future. Each of the five existential moods will receive a chapter of its own. In brief, these moods are:

(1) *Indestructibility* (ancient times to the 1850s). The notion that human beings are in some sense a permanent fixture of reality—that we are fundamentally indestructible—is found in many cosmological theories and mythological

systems dating back at least to the Presocratics of Ancient Greece. This does not mean that some ancient peoples never imagined the universe without us. Those who did, though, almost always believed that this would only be a temporary state of affairs. In other words, they accepted the possibility of our extinction in a minimal sense, but rejected the idea that we could disappear forever, which is why I said above that the idea dates back to the ancient world. Nonetheless, the belief in our indestructibility took on a more radical form once Christianity came to dominate the Western worldview. During this ~1,500-year period, naturalistic extinction *of any sort* would have been seen by virtually everyone as impossible in the three senses specified earlier—metaphysical, ontological, and eschatological. This offered a reassuring sense—a feeling of "Comfort" and "perfect security," to quote two notable figures writing at the end of this period—that no matter what might happen in the future, no matter what catastrophes might befall humanity, we will ultimately endure forever. (Chapter 2.)

(2) *Existential Vulnerability and Cosmic Doom* (1850s to the mid-twentieth century). This was initiated by the discovery of the first scientifically credible kill mechanism, that is, the Second Law of thermodynamics, which entails that our planetary and/or cosmic abode will become increasingly inhospitable to life, until no life at all is possible. The Second Law thus stamped an expiration date on humanity's forehead, though physicists did not expect this to happen for many millions of years. Nonetheless, not only did it become clear to many that our extinction is, in fact, *possible*, but the fundamental laws of nature implied that this outcome is ultimately *inevitable*—a double trauma that led many to despair about the purpose or meaning of life (see Chapter 8). The background condition for this shift in existential moods was, of course, the loosening of religion's stranglehold on conceptions of human nature and the future of humanity (by the time this mood descended, the Great Chain had already been mortally wounded, but the ontological and eschatological theses remained largely intact). As we will see, the decline of Christianity and the discovery of the first credible kill mechanism swung open the floodgates for all sorts of fascinating and creative speculations about how humanity might die out, although only the Second Law was widely accepted by scientists (or natural philosophers) as posing an *actual* threat to our survival. (Chapter 3.)

(3) *Impending Self-Annihilation* (1945/mid-1950s to the 1980s/early 1990s). The emergence of this shift coincided with the onset of the Atomic Age in 1945, although it did not solidify until the second half of the 1950s, after it became clear to many leading scientists that even a relatively small-scale thermonuclear conflict could blanket the entire planet with lethal quantities of radioactive particles. The following decades witnessed a proverbial explosion of credible new anthropogenic catastrophe scenarios, some relating to nuclear weapons (for example, the nuclear winter hypothesis), others associated with

environmental contamination and degradation caused by pollution and overpopulation, along with the possibility of runaway climate change, and still others linked to more hypothetical threats from biological weapons, self-improving artificial intelligence, and atomically precise nanotechnology. Suddenly, human extinction was not merely inevitable in the very long run but terrifyingly probable in the *near term*, due not to one but a *multiplicity* of distinct threats. (Chapter 4.)

(4) *Nature Could Kill Us* (1980/early 1990s to the late 1990s/early 2000s). This was initiated by the realization that natural phenomena like asteroids, comets, and volcanic supereruptions can affect the entire planet and precipitate mass extinctions, during which large numbers of species perish on geologically brief timescales. Prior to this, since at least the 1850s and stretching through most of the Cold War period, it was widely believed that naturally occurring catastrophes were always localized affairs, limited to circumscribed regions of our planet. The shift to this mood, which took longer than any other, coincided with the dramatic implosion of an Earth-sciences paradigm known as *uniformitarianism* during the 1980s, due in large part to novel research showing that the non-avian dinosaurs died out 66 million years ago after a large asteroid struck Earth. Suddenly, with uniformitarianism replaced by an unsettling new paradigm called *neo-catastrophism*, it became clear that we do *not* in fact live on a safe planet in a safe universe but are no less vulnerable to sudden annihilation from natural hazards than the dinosaurs were. Sooner or later, Nature will try to commit filicide. (Chapter 5.)

(5) *The Worst Is Yet to Come* (late 1990s/early 2000s to the present). Unlike the previous three shifts in mood, this wasn't driven by the discovery of any new kill mechanisms. Instead, it was catalyzed by two developments: first, a radical new philosophical perspective on the moral importance of avoiding our extinction, which directly inspired efforts to outline a maximally comprehensive picture of our existential predicament, or what I will call the "threat environment." This involved, in part, a "futurological pivot" toward the various emerging and anticipated future risks arising from advancements in biotechnology, synthetic biology, molecular nanotechnology, and artificial intelligence (including "artificial superintelligence"). The second triggering factor concerned new research in the environmental sciences showing that human-caused climate change, global biodiversity loss, and the sixth major mass extinction event pose dangers that are far more urgent and catastrophic than was previously known. This coincided with the idea that humanity (specifically the Global North) has initiated a new geological epoch called the "Anthropocene," in which our actions have permanently altered the geological record. At the heart of this mood was the frightening suspicion that however perilous the twentieth century may have been, the

> twenty-first century will be *even more so*. In other words, the worst is yet to come. (Chapter 6.)

As stated, the two main components of the explanatory-predictive hypothesis that underlies the above periodization are enabling conditions and triggering factors. A key idea that connects these components—expounded in much more detail below—is what I will call an "existential hermeneutics." This denotes the interpretive lens through which an empirical model of the physical universe and everything it contains (including us) yields a picture of the *threat environment*. For example, a certain kind of *religious* existential hermeneutics might lead one to minimize or entirely dismiss the risk of an asteroid collision: if God is in control, if humanity is immortal, and if the future must unfold according to his prewritten plan, then we have no reason to worry. (There are, in fact, many historical examples of precisely this sort of reasoning, as we will see.) However, a *secular* existential hermeneutics according to which there is no omnibenevolent God watching out for us, humanity is no less vulnerable to annihilation than any other species, and there is no grand narrative of cosmic history in which humanity plays a central role might lead one to a rather different conclusion: we should be extremely worried if NASA announces that a large asteroid will intersect with Earth's orbit. Hence, even if people accept the same empirical data about potentially hazardous phenomena in our vicinity of the cosmos, different existential hermeneutics could lead to wildly different mappings of the threat environment. Even more, this has obvious *practical* implications: some who accept a religious hermeneutics might see an incoming asteroid as an occasion for elation, since, for Christians, the other side of the apocalypse is paradise. This could thus promote passivity in the face of danger. In contrast, those who accept a secular hermeneutics might see the asteroid as requiring immediate action to divert the incoming mass away from our planet. In a morally indifferent universe, it is our—and entirely our—responsibility to ensure the continued survival of our species.

Right and Wrong, Good and Bad

So far, our focus has been entirely on the possibility, probability, etiology, and so on of our extinction, which I bundled together under the concept of an *existential mood*. But there is a cluster of additional questions about our extinction that concern a related but distinct matter, namely, the *ethical and evaluative* implications of disappearing—questions that we can place within a philosophical subfield that I will call "Existential Ethics."[15] Examples include: Would causing or allowing our extinction be right or wrong? For what reasons? Under which conditions? Would our extinction, however it comes about, be good or bad, better or worse, or perhaps just neutral? For what reasons? Under which conditions? Is everything meaningless if extinction is inevitable? Would extinction undermine

the significance of past progress? Would knowledge of our imminent extinction deprive our lives of important sources of value? Do we have an obligation to create future people? Do the unborn have a right to exist? Are there moral obligations to past individuals that would make dying out wrong? And so on.

As we will see, philosophers have proposed a fascinating array of answers to these questions. According to some, causing or allowing our extinction would be very bad, and therefore wrong, because of the associated *opportunity costs* of no longer existing, such as the loss of all future generations, or the loss of further scientific and moral development. I will classify these as "further-loss views," which can take many different forms and be interpreted in many different ways. Others believe that the badness or wrongness of our extinction boils down entirely to the *manner* in which it is brought about: if there is nothing bad or wrong with *how* we go extinct, then there is nothing bad or wrong with extinction, period. This has the intriguing implication that human extinction does not pose any *unique moral problem*. It is different in degree rather than kind from other effects our actions might have or other catastrophes that might befall us. I will call the class of positions that accept this idea "equivalence views" and defend a version of it in Chapter 11. Still others maintain that the non-existence of our species would be *less bad* than continuing to exist—or perhaps even positively *good*—since it would mean the absence of all human suffering. This has led some to argue that we should actively strive to produce this very outcome, preferably through voluntary, peaceful means such as by refusing to have children. Let's label these "pro-extinctionist views," which, like the other two main categories above, can be fleshed out in a variety of ways.

Because the questions of Existential Ethics are distinct from those linked to existential moods, how philosophers have answered them over time constitutes its own unique history. For ease of exposition, I will refer to the history of existential moods as "History #1" and the history of Existential Ethics as "History #2."[16] These are of course *causally* related: it wasn't until our extinction was seen as possible (during the nineteenth century, but especially after the second existential mood solidified) that philosophers began to seriously contemplate the topic, and not until the latter twentieth century (coinciding with the third and fourth existential moods, then continuing into the fifth) that it became the focus of sustained and systematic investigation. This makes sense, of course, since what reason is there for pondering the ethics of something that one believes is impossible? We don't, for obvious reasons, write books about the ethicality of eating unicorns raised in deplorable conditions on factory farms. Hence, only once it became clear that human extinction is really possible and, later, that we could actually bring this about did philosophers begin to seriously consider the normative aspects of extinction. History #1 thus provides, as it were, the background context of History #2: in certain important respects, the contours of History #1 shaped those of History #2, although we will see that the causal relationship between these histories *reversed* around the turn of the twenty-first century, when

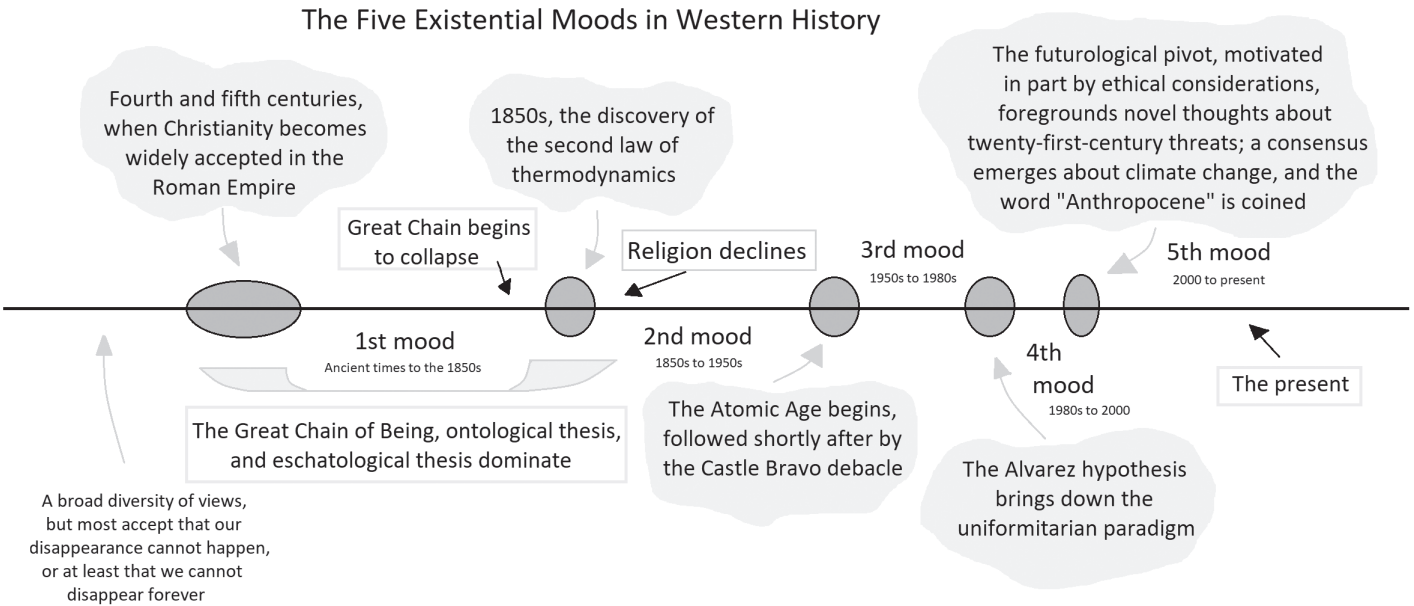
The Five Existential Moods in Western History
Fourth and fifth centuries, when Christianity becomes widely accepted in the Roman Empire
1850s, the discovery of the second law of thermodynamics
The futurological pivot, motivated in part by ethical considerations, foregrounds novel thoughts about twenty-first-century threats; a consensus emerges about climate change, and the word "Anthropocene" is coined
Great Chain begins to collapse
Religion declines
3rd mood
1950s to 1980s
5th mood
2000 to present
1st mood
Ancient times to the 1850s
2nd mood
1850s to 1950s
4th mood
1980s to 2000
The present
The Great Chain of Being, ontological thesis, and eschatological thesis dominate
The Atomic Age begins, followed shortly after by the Castle Bravo debacle
The Alvarez hypothesis brings down the uniformitarian paradigm
A broad diversity of views, but most accept that our disappearance cannot happen, or at least that we cannot disappear forever

Figure 1.3 Rough outline of the five existential moods in Western history.

developments in Existential Ethics played a crucial role in triggering the shift to the fifth existential mood, our current mood.

As with the first history, this second history can also be partitioned into segments, which I will refer to as "waves." There are three points to make about this. First, I use "waves" instead of "periods" because, in contrast to the well-defined periods of History #1, with each existential mood emerging and solidifying in response to specific, datable events, the boundaries between these waves are often vague and overlapping. Furthermore, the transitions from one to another exhibit a kind of ebb and flow of ideas, unlike the rapid shifts between existential moods. Second, whereas I have defined existential moods as involving a certain *uniformity* of agreement about our existential predicament (that is, a *stable set* of answers to questions about the possibility, probability, and so on, of our extinction), every wave discussed below encompasses a *diversity* of viewpoints on the core questions of Existential Ethics. This does not mean that the periodization of History #2 is arbitrary: one can still identify particular waves in the ocean even if their boundaries are inherently ill-defined and the molecules they contain are jostling about in opposite directions. Third, I will count a total of four waves in History #2, where these waves do not straightforwardly correspond to the five periods of History #1. In brief, the initial wave spans the first and second existential moods; the second wave extends across the third and fourth existential moods (as the discovery that natural hazards could annihilate us did not have much effect on the way philosophers thought about our extinction); and while the third wave *coincides* with the onset of the fifth existential mood (due in part to the reversal mentioned above, whereby History #2 changed the course of History #1), the fourth wave arose only in the *past five years* or so, as of this writing. This may appear somewhat complicated at first glance, but the mismatch between periods and waves makes good sense, as Part II will attempt to show.

The Four Waves

Following the precedent set above, let's take a quick bird's-eye view of the four waves, each of which will receive its own chapter:

(1) *Calamity, Pessimism, and the Greatest Conceivable Crime* (early modern period to the 1950s). This covers ruminations about our extinction within the Western tradition until the third existential mood commenced in the mid-twentieth century. Most of the earliest examples were articulated by atheistic philosophers in the nineteenth century, especially its second half, although one can trace the roots of Existential Ethics back to at least the early 1700s. During this wave, some philosophical thinkers suggested that our collective non-existence would be bad because it would entail the loss of things we care about, such as knowledge and laughter, or because it would prevent the realization of all future happiness. Others argued that, since our lives are full of suffering, we

should actively work to bring about our extinction, if not (somehow) eliminate the very possibility of life existing anywhere in the universe. Still others, in a rather different mode of reflection, wondered whether human existence can be meaningful given that, according to the Second Law, the universe will eventually sink into a frozen state of eternal lifelessness. Does anything really matter if, in the end, all will be lost? (Chapter 8.)

(2) *An Explosion of Insights* (1950s to the ~2000s). The development of nuclear weapons provided the first credible means of self-annihilation, and hence the Atomic Age inspired a number of philosophers to consider the core questions of Existential Ethics more vigorously than intellectuals had in previous eras. A common theme among early pioneers of the field was that our newly acquired *powers of action*, our ability to affect every person on the planet as a result of nuclear weapons or environmental degradation, has rendered traditional ethical systems outdated or obsolete. We thus need a new *kind* of ethics, one specifically designed for the possibility of "omnicide," or "the murder of everyone." Some attempted to construct such an ethical framework, while many others proposed novel arguments, either within or outside a new ethics, for why our extinction might be right or wrong, good or bad, better or worse. For example, the fact that humanity could exist for millions or billions of years into the future, and that continued progress could make future lives much better than current lives, may provide reasons for safeguarding our collective survival. Or perhaps the badness of extinction concerns the fact that it would remove the only rational and moral beings in the known universe. Others argued that, on a "person-affecting" theory of ethics, while dying out in a global catastrophe would *itself* be very bad, the subsequent *outcome* would not be, since there would be no one around to suffer the loss of humanity. Some even argued from a radical environmentalist perspective that humanity should stop existing because of our deleterious impact on the biosphere, with a few fringe actors endorsing involuntary omnicide. More than any other wave, this one saw the articulation of an extraordinary range of innovative new ideas, some of which influenced views proposed during the next two waves. (Chapter 9.)

(3) *Astronomical Value, Longtermism, and a Dying-Extinction* (~2000s to the present). This wave is notable for two developments in particular. First, it witnessed the formation of the first *cohesive research program* focused on the ethics of human extinction and related scenarios, which were called "existential risks." Central to this research program were ideas drawn from the futurological vision of transhumanism, the ethics of utilitarianism, and a branch of cosmology known as physical eschatology. The result was a radical further-loss view according to which our extinction would constitute a moral tragedy of quite literally *cosmic proportions*. Hence, reducing the risk of extinction (and existential risks more generally) should be the top "global priority" for our species. Over the past decade, this has evolved into an ethic called "longtermism," which has

become influential far beyond the perimeter of academia, something that few philosophical ideas can boast of doing. Second, at precisely the time that the idea of existential risks was being developed, a diametrically opposed view took shape, namely, "antinatalism," which, on this version, claims that birth is a net harm, life is much worse than we typically believe, and we should all stop having children. The leading advocate of this view further argued that the outcome of extinction would be positively good, since it would mean no more births and no more suffering. We should thus—echoing earlier theorists—take steps to precipitate our extinction, and we should do this sooner rather than later. These were the two defining features of the third wave. (Chapter 10.)

(4) *Alternative Approaches* (~2017 to the present). The most recent wave emerged within the Analytic tradition of Western philosophy over the past five years or so, partly in response to the first development of the previous wave. A unifying feature of this wave has been an approach to Existential Ethics that is non-utilitarian or, more generally, non-consequentialist in orientation. Some have argued that, according to a *contractualist* theory, anthropogenic human extinction would be wrong *only insofar* as it causes harm to those living at the time, while others proposed that we should avoid extinction because of the particular value that humanity might possess ("final value"), or because extinction would undermine many of the activities that make our lives "value-laden."[17] However, still other philosophers made the case that our disappearance from the universe might on balance be good, and hence that if one were to see an asteroid heading toward Earth, one shouldn't try to redirect it away from us. After a critical survey of these positions, I will then outline my own views on the matter, which combine elements of the equivalence and pro-extinctionist views that together yield the rather surprising conclusion that, in practice, we should vigorously work to *avoid* our extinction. (Chapter 11.)

Readers may have noticed that this summary skips over Chapter 7, which opens Part II. This is because Chapter 7 does not discuss any historical wave within Existential Ethics, but rather provides a theoretical foundation for the second half of the book, which will enable us to understand more clearly the various positions outlined in the Existential Ethics literature. In doing so, I distinguish between multiple senses of "humanity" and six types of "extinction" that are directly relevant to ethical and evaluative assessments of our disappearance (all of which build on the definition proposed above). I will also argue that, in reflecting on what might be right or wrong, good or bad, better or worse about human extinction, it is imperative to differentiate between (a) the process or event of Going Extinct and (b) the state or condition of Being Extinct. As noted earlier, some ethical theories entail the equivalence thesis, which asserts that the wrongness/badness of extinction is wholly reducible to *how it comes about*, while other theories identify some additional loss associated with the *outcome* as contributing to the badness of

our disappearance. Hence, the first concerns the details of Going Extinct, whereas the second also focuses on the opportunity costs of Being Extinct. There are, furthermore, many pro-extinctionist views that admit that Going Extinct may be very bad, as it could cause harms and cut lives short, yet maintain that the resulting state or condition of Being Extinct would be better than Being Extant (as we can say), if not in some sense good. As we will see, the equivalence view is theoretically compatible with certain pro-extinctionist positions, although one who accepts the former need not accept the latter.

Those interested in Existential Ethics are especially encouraged to look over this chapter, since the philosophical literature on the topic is replete with confusions and imprecise statements arising from a failure to recognize that "human extinction" is highly polysemous. For example, some arguments for the conclusion that, as one might see it expressed in the literature, "human extinction would be wrong" only concern *particular types* of human extinction, while other arguments target *every type* of extinction. Being clear about *what it is* we are talking about is critical for the field to progress.

In sum, Part I is largely an intellectual history, while Part II is a history of ethics. And while the periodization of History #2 is imprecise around the edges, I take the periodization of History #1 to be a more or less objective fact, something discovered rather than invented.

Explanation and Prediction

Why care about the origins and evolution of the idea of human extinction in the first place? What is the value of Part I's intellectual history and Part II's reconstruction of the development of Existential Ethics? Why, in short, does this study matter? One answer comes from Aristotle's *Politics*, written circa 350 BCE, in which he declares that "he who thus considers things in their first growth and origin, whether a state or anything else, will obtain the clearest view of them." As the opening paragraphs of this chapter indicated, *human extinction* is so commonplace today that few have any inkling that the idea is a quite recent addition to our shared library of concepts. Understanding this fact alone can give one a deeper appreciation of the idea and its significance in contemporary discourse.

Even more importantly, anticipating how the idea of *human extinction* might evolve in the future—because there is no reason to believe that its story has ended—requires some grasp of the causal factors that have shaped its journey so far. A causal story that deals with general categories of phenomena rather than particulars can provide not just an explanation of what happened in the past but predictions of what might happen in the future. To illustrate, consider that historians can give a detailed account of how World War I began: a Yugoslav nationalist named Gavrilo Princip shot and killed Archduke Franz Ferdinand; Austria-Hungary then declared war against Serbia; this led the countries allied with Austria-Hungary (Germany and Italy) to declare war

on the countries allied with Serbia (United Kingdom, France, and the Russian Empire); and so on. Here we have a historically unique concatenation of causes and effects, with each effect except for the last—the explanandum of interest—functioning as the next cause in the sequence, that explains the origins of the Great War, yet does not enable one to predict the onset of future wars, at least not in any reliable way.

In contrast, the triggering factors and enabling conditions that explain the course of History #1 are sufficiently general to make rough predictions about how this history might unfold in the future with some confidence. Rather than "A caused B caused C . . .," we have "if something of type A is the case, then something of type B will be the case . . ." More specifically, if the decline of religion and the discovery of kill mechanisms account for the shifts in existential mood, then the further decline of religion and the discovery of additional kill mechanisms could induce yet another shift in the coming decades. Alternatively, if recent trends of secularization were to reverse and religion were to become more widely adopted, then we should expect the idea of human extinction to fade into the background, perhaps becoming incoherent once again, like the concept of *married bachelor*. Hence, understanding the history of *human extinction* could enable one to anticipate its evolution later this century, which may prove important. Why? Because if humanity *really is* at risk of going extinct, but if most people, or those holding the reins of power, do not believe that this outcome is even possible, then the probability of catastrophe could rise, perhaps significantly. By analogy, if one were convinced for some reason that they could never get in a bicycle accident, they may stop wearing their helmet, which would thus increase the chance of serious injury. There are, in other words, major practical implications to understanding this history.

Let's now turn to History #1.

Notes

1. Thanks to Olle Häggström for this anecdote (personal communication).
2. Note that I will use italics both for emphasis and to indicate that I am referring to a concept or idea rather than a lexical item (a word or set of words) or phenomenon in the world. Hence, *human extinction* would refer to the concept, whereas "human extinction" would refer to the term. I will also take "concept" and "idea" to be interchangeable.
3. The one survey that I am familiar with was conducted by Bruce Tonn and published in 2009, which consisted of only 600 respondents. See footnote 10 for details. Note also that by "the West," I mean the group of peoples in Western Eurasia who identified themselves as the inheritors of the legacy of classical Greece and Rome, and those regions of the world whose Indigenous cultures they supplanted through the oftentimes genocidal process of colonization.
4. Quoted in Moltmann and Kohl 2004. Similarly, Alison McQueen writes in *Political Realism in Apocalyptic Times* (2017):

> [I]n contrast to the Judeo-Christian apocalypse, there is no system of belief that renders nuclear annihilation meaningful, no theodicy that endows it with ultimate justification, and no promissory narrative that consoles the terrified and trembling. It is instead an apocalypse without redemption—an end that can only be confronted as a naked absurdity (quoted in Zimmer 2022).

5. This literature includes, most notably, David Sepkoski's *Catastrophic Thinking: Extinction and the Value of Diversity from Darwin to the Anthropocene* (2020), Thomas Moynihan's *X-Risk: How Humanity Discovered Its Own Extinction* (2020), and Dan Zimmer's exceptional 2022 dissertation *The Immanent Apocalypse: Humanity and the Ends of the World*.
6. Moynihan 2019. Unfortunately, I have found an enormous number of errors in Moynihan's 2020 book *X-Risk*. For a list of such errors in just the first few pages of his manuscript, see Torres 2021.
7. Michel et al. 2011.
8. Consistent with this, the survey conducted by Bruce Tonn found that "Christians and Jews overwhelmingly do not believe that humans will become extinct but secular and non-religious people strongly believe otherwise" (2009).
9. Put differently, "immortal human" would have been a pleonasm, whereas "human extinction" would have been a contradiction.
10. Walls 2008.
11. Hill 2002. Indeed, Bart Ehrman notes that

> The notion of individual resurrection, developed at the tail end of the Hebrew Bible period, arose principally in response to questions of theodicy. How is it fair—or, rather, how can God be just—if the wicked prosper and then die and get away with it? Or if the righteous suffer for doing God's will and then perish in misery? Surely there must be some kind of recompense when we pass from this world of mortality. As evidenced in the non-canonical book of 1 Enoch and then the canonical Daniel, Jewish thinkers developed views of the afterlife that explained it all (2021).

12. Although interpretations of Christian eschatology have changed over time, and while the study of eschatology has waxed and waned—for example, during the nineteenth and *early* twentieth centuries, little attention was given to the topic, leading Ernst Troeltsch to famously state in 1925 that "nowadays the eschatological office is closed most of the time" (quoted in Walls 2008, 7)—the centrality of cosmic eschatology within Christianity is indisputable. Historically speaking, traces of both amillennialism and premillennialism can be found in the very early period of Christianity, although amillennial eschatology became the dominant interpretation during (a) the Middle Ages, due in part to Saint Augustine's influence, and (b) among the Reformers. According to amillennialism, "the thousand years of [Revelation] 20 represent the entire Christian era, beginning with the cross, resurrection, and ascension of Christ and ending with the second coming," or *Parousia* (Neall 2005). At the end of this period, Satan will deceive the nations of Earth, and a series of battles, e.g., the battles of Armageddon and of Gog and Magog against "the beloved city" (Revelation 20:9), will occur, culminating with "the second coming of Christ, the judgment of the wicked, and the rewarding of the righteous—events which mark the end of the millennial Christian era" (Neall 2005, 186). On the other hand, postmillennialism, with its reassuring hope of continued progress over time, gained adherents most notably during the Enlightenment, during which the idea of *progress* was foregrounded by philosophers like Condorcet; however, we will see in Chapter 4 that premillennialism—especially premillennial dispensationalism—became immensely popular, especially among the general public, during the latter half

of the twentieth century, which is sometimes dubbed the "Century of Eschatology" (see Walls 2008). As Hans Urs von Balthasar noted in 1957, responding to Troeltsch's earlier statement, the eschatological office had been opened for business once again and was now "working overtime" (Schwöbel 2000).

13. Ringmar 2018.
14. See OED 2022.
15. This term appears in an excellent critique of "longtermism" (see Chapter 10) written by Zoe Cremer and Luke Kemp, although their definition is different than mine. For example, they argue that it is important to "separate[e] the study of extinction ethics (ethical implications of extinction) and existential ethics (the ethical implications of different societal forms)," both of which "should be analysed separately from" the study of extinction risks. This roughly corresponds, I believe, to my distinction between the study of the ethical and evaluative implications of extinction, on the one hand, and the study of kill mechanisms (and related phenomena) on the other. See Cremer and Kemp 2021.
16. To my embarrassment, I only became aware of Dipesh Chakrabarty's 2000 "History 1" and "History 2" after completing a draft of this book. Thanks to Dan Zimmer for apprising me of Chakrabarty's work.
17. See Scheffler 2013, 2018; see also Chapter 11.

Part I

Existential Moods

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2 Beginnings of "The End"

A Deluge of Flood Myths

One of the first objections I often hear when describing a central thesis of Part I—that for much of Western history, just about everyone assumed that humanity is indestructible—is that tales of global catastrophes, even the complete obliteration of humanity, are common in religious and mythological thought. In some cases, these involve one-off catastrophes in the past associated with, for example, failed attempts by the gods to create humanity. In others, they are the unavoidable result of endless cosmic cycles that pass through stages of birth, growth, decline, death, and rebirth, extending forever in both temporal directions. In still others, they are anticipated future events embedded within eschatological narratives that culminate with devastating wars and supernatural disasters.

Let's begin by examining a number of examples, the overwhelming majority of which do not, in fact, suggest that humanity was or could be at risk of destruction. We will then turn to the ~1,500-year period during which *human extinction* was "blocked" by the three beliefs specified in Chapter 1 and show how one of these, the Great Chain of Being, was dealt a mortal blow at the turn of the nineteenth century. By virtue of the many different topics covered by this chapter, it will be the most discursive in the book. It will also occasionally deviate from the Western tradition, as doing so will help underline just how ubiquitous the assumption of our indestructibility has been across cultural space and time.

The most obvious example of the first is the flood myth, found in the written and oral traditions of peoples around the world. It is, indeed, something close to a universal motif, with the same basic structure and message.[1] One of the earliest instances comes from *Atrahasis*, an epic poem within the Akkadian literature, which was first recorded during the Late Old Babylonian Period, in the eighteenth century BCE.[2] In it the Sumerian god of wind, storms, Earth, and air named Enlil tries to destroy humanity on three occasions, each separated by 1,200 years, because our noise-making disturbed his sleep. The first attempt involved a plague, the second a drought, and the third a famine, though all failed because of the god Ea.[3] Enraged, Enlil then sends a flood

DOI: 10.4324/9781003246251-3

to exterminate humanity, although Ea once again thwarts his plan, warning a man named Atrahasis who builds an ark and survives.

While this story is little-known today, it may have been the basis of the flood myth in the *Epic of Gilgamesh*, which many consider to be one of the greatest masterpieces of world literature.[4] Its account of Enlil's wrath over humanity's noisiness similarly involves a great deluge, though in this case the (Babylonian) main character is named Utnapishtim, who builds a boat in which "all the living beings that I had," including "all my kith and kin . . . all the beasts and animals of the field" take refuge.[5] After seven nights and six days of rain, Utnapishtim and the other survivors then emerge to repopulate the planet.

The most famous Western flood myth, though, is the Noachian story of the Book of Genesis, which very likely drew from one or both of the Akkadian narratives above. Once again, the deluge results from divine wrath, in this case because "all the people on earth had corrupted their ways" (Genesis 6:12). Hence, God decides to "put an end to all people" and to "destroy all life under the heavens," but due to Noah's righteousness, God spares Noah, his wife, his sons Shem, Ham, and Japheth, and his sons' wives (Genesis 6:13, 17).

One also finds several flood myths within Greek mythology, the most well-known being the flood of Deucalion, the son of Prometheus. In this story, Zeus becomes livid after a young boy is sacrificed to him and consequently unleashes a catastrophic deluge. However, Prometheus tells his son Deucalion about this beforehand, so Deucalion builds an ark that enables him and his wife Pyrrha to survive the downpour, the only two on the planet who don't perish. According to Plato's dialogue *Timaeus*, this occurred in the tenth millennium BCE and is actually one of many disasters that have wiped out *nearly everyone*. The most devastating of these involved fire or water; in the former case those in the river valleys survive, while in the latter only shepherds in the mountains do. The deluges cause the loss of all culture, which must then be rebuilt from scratch. According to Critias, the Athenian statesman Solon—one of the Seven Sages and a cousin of Plato's mother—traveled to Egypt and was told by priests that Athens has been obliterated many times in the past, with each instance wiping out all the historical knowledge of the city that had accumulated up to that point. As one priest says, "none of you but the unlettered and uncultured" remained after the catastrophe, "so that you become young as ever, with no knowledge of all that happened in old times in this land or in your own." These stories are reiterated in (a) the subsequent unfinished dialogue *Critias*, in which Plato insists that many large floods have previously occurred, and (b) Plato's *Laws*, where he again references the "traditions about the many destructions of mankind which have been precipitated by deluges and pestilences, and in many other ways." In fact, the main topic of the *Critias* was to be the story of Atlantis, a "great and wonderful empire" that was defeated by Athens, after which both were destroyed by a great earthquake, tsunami, and flood, thus causing Atlantis to disappear under the sea.

Not only have such catastrophes occurred in the past, according to Plato, but they will also happen in the future. As the Egyptian priest tells Solon in the *Timaeus*, "there have been and there will be many and diverse destructions of mankind." This idea was subsequently elaborated by Plato's student Aristotle, who suggested the possibility of "cyclic floods" that destroy whole populations and which may be associated with the so-called *Great Year*, which Plato referred to as the "perfect year." The idea is that just as a month occurs when the moon completes its orbit around Earth (the word "month" being etymologically related to "moon"), and just as a year occurs when the sun completes its orbit around our planet (on a geocentric model of the solar system), so too is there a "great" or "perfect" year that occurs whenever the sun, moon, and six other stars or planets end up in perfect alignment relative to Earth, which was thought to happen every 36,000 years.[6] The completion of each cosmic cycle then triggers cataclysmic floods that wipe out previous civilizations, leaving only a few survivors. Aristotle thus believed that proverbs and aphorisms popular during his time were bits of wisdom from people who lived prior to the last catastrophe. Writing in the *Metaphysics*, he asserts that certain "inspired saying[s] . . . have been preserved as a relic of former knowledge," most of which was lost and therefore must be rediscovered.

Cycles and Arrows

Many other mythological systems reference worldwide disasters as part of their creation narratives. As the Egyptologist Geraldine Pinch writes, a common theme across mythological systems is God or the gods destroying "the unsatisfactory part of humanity"—i.e., cleansing the world of evil races—resulting in "several attempts at creating people before they are satisfied."[7] An example comes from the ancient Egyptian *Book of the Heavenly Cow*, which explains how Ra, the god who created the world, found humanity plotting against him. After consulting other gods about what to do, he decides to punish humanity, delegating this task to Hathor, the goddess of the sun. On the first day, Hathor slaughters many people in the desert, stating that she has "overpowered humanity and it was sweet to my heart."[8] She plans to continue the attack the following day, but for reasons that are unclear, Ra changes his mind and tricks Hathor into forgetting about the mission by getting her drunk. Consequently, humanity survives.

Another example outside the Western tradition that illustrates Pinch's point comes from the elaborate creation narrative of the Mesoamerican Aztecs (1300–1521). This involves four worlds, or "Suns," being created and destroyed prior to the emergence of current humanity. In each case, the humans who existed were annihilated: first by jaguars (First Sun), then by fierce winds of a hurricane (Second Sun), a fiery rain that transformed everyone into turkeys, butterflies, and dogs (Third Sun), and a great deluge (Fourth Sun), which two people survive (Tata and Nene) but are turned into dogs by the gods who cut off their heads and, rather humorously, attach them to their buttocks. The gods then recreate the

original humans in the Fifth Sun, which is maintained through ritualistic human sacrifice. The mythologies of the Hopi and Navajo peoples, who lived around the Four Corners region of the United States, specify similar episodes of annihilation and creation, and the same basic pattern of creation and recreation is found in the "Five Ages of Man" adumbrated by the Greek poet Hesiod (750–650 BCE) in his *Works and Days* (c. 700 BCE).

Within Eastern belief systems like Hinduism and Buddhism, one finds cyclical eschatologies in which the cosmos oscillates between periods of renovation/growth and deterioration/decline. Buddhism, for example, posits cosmic cycles called "great eons," each of which consists of four phases or "incalculable eons." The first leads to the destruction of the entire universe and is associated with immorality, sickness, epidemics, famines, and wars. The universe then stagnates in a state of nonmanifestation until it "gradually comes back into being" during the third, which ushers in the final phase of cosmic existence.[9] However, the cosmos is never completely destroyed: some living beings survive and are reborn into the world once it becomes manifest again.

Cyclical models of cosmic evolution were also proposed by the ancient Greek philosophers. For example, the Presocratic philosopher Xenophanes of Colophon (c. 570–478 BCE) argued that the world alternates between two extremes: wetness/water and dryness/Earth. When the first occurs, the oceans submerge all the land, turning it into mud and causing everyone alive at the time to perish. But when dryness dominates, humanity and other living creatures reappear. Our disappearance is thus complete but temporary. A similar account was put forward by the poet-sage and vegetarian Empedocles (c. 494–434 BCE). In his poem *On Nature*, of which only fragments remain, he identifies the two extremes as corresponding to Love and Strife, the cosmic personifications of attraction/combination and repulsion/separation. "By turns," he declared, "they dominate while the time revolves." In the case of Love, everything is fused into an undifferentiated mass and no life is possible; in the case of Strife, everything is pulled apart and, once again, life becomes impossible. It is during the transition between Love and Strife, Strife and Love—on one interpretation—that living creatures emerge (through a form of natural selection).[10] As Empedocles wrote:

> A twofold tale I shall tell: at one time it grew to be one only from many, and at another again it divided to be many from one. There is a double birth of what is mortal, and a double passing away; for the uniting of all things brings one generation into being and destroys it, and the other is reared and scattered as they are again being divided. And these things never cease their continuous exchange of position, at one time all coming together into one through Love, at another again being borne away from each other by Strife's repulsion.[11]

Yet another example comes from the Stoics of the Hellenistic period (323–31 BCE), who proposed a cosmological theory involving *ekpyrosis*, whereby the

cosmos is periodically consumed and purified by a great conflagration—an idea that the earlier (non-Stoic) philosopher Heraclitus may have also accepted.[12] However, once the purification-by-fire event has occurred, the cosmos starts over again, with all things unfolding exactly as they did before. Consequently, as Chrysippus of Soli, an ancient Greek Stoic from the third century BCE, wrote in his treatise *On Providence*, "it is evidently not impossible that we too, after our death, will return to the shape we are now, when certain periods of time have elapsed."[13] The German philologist Friedrich Nietzsche would later popularize this model as the "eternal return" or "eternal recurrence."[14]

The notion that the fundamental structure of time takes the shape of a circle rather than a line has, in fact, been the default assumption throughout much of history. This is captured most memorably by the Egyptian image of the Ouroboros, a snake eating its own tail, which "signified the capacity of the universe to perpetually renew itself, so that every end could also be a beginning."[15] There were, to be sure, linear narratives as well, but these were typically enfolded *within* larger cycles that stretch infinitely, or at least interminably, into the past and future. Consider the ancient Egyptian *Coffin Texts* (2100 BCE) and *Book of the Dead* (1550 BCE), which indicate that, as the creator-god Atum declares in the latter, "in the end I will destroy everything that I have created; the Earth will become again part of the Primeval Ocean, like the abyss of waters in their original state." This looks like a linear narrative: the world had a beginning and will someday come to an end. Yet the Primeval Ocean, during which only Atum and Osiris exist, will be followed by a period of renewal. The world starts over. Another example is the eschatology of Norse mythology, which originated from the North Germanic peoples (Scandinavians) in the ninth century CE. Our world is prophesied to end through a series of bloody battles, a worldwide flood (the land sinking into the sea), and a massive conflagration that engulfs the planet. This is called *Ragnarök*, meaning "final Fate of the Gods." Several gods will perish in this disaster, including the thunder-and-lightening deity who wields a hammer and protects Earth, Thor. The whole human population will also be annihilated except for two lone survivors: a man named Lif (meaning "life") and a woman named Lifthrasir (meaning "lover of life"), who then repopulate the planet. Hence, *Ragnarök* initially looks like a linear tale of future destruction, at which point the world ends, but in fact this is part of a larger undulation of destruction and rebirth, whereby the earth emerges from the waters that have covered it, humanity begins anew from a single couple, and another generation of gods arises.[16]

A genuinely linear view of time—as consisting of a definite beginning and end of the world—was thus a novel innovation that, as such, deviated from the older view of time as a loop by replacing it with an arrow. According to the historian Norman Cohn, this radical new idea originated with the ancient Persians, exemplified by the cosmogony and eschatology of Zoroastrianism, a monotheistic religion founded by the prophet Zoroaster (or Zarathustra), who may have lived during the tenth century BCE.[17] On this account, cosmic history will culminate

with the appearance of a virgin-born messiah (the *Saoshyant*), an Armageddon-like battle, a bodily resurrection of the dead, and a final judgment of humanity by God (Ahura Mazda). The striking parallels between Zoroastrian eschatology and later Christian and Islamic narratives of the world's end might not be coincidental:[18] the storyline motifs of the former may have been picked up by the Jewish people during the Second Temple period, when for roughly two centuries Israel was subject to the Persian Empire, and subsequently transferred to the other Abrahamic faiths.[19] Hence, Christians anticipate the Second Coming of Christ (born of a virgin), Battle of Armageddon, one or more resurrections of the dead, and a final judgment, and both the Sunni and Shi'ite branches of Islam accept a similar sequence of end-times happenings. Within the West, this conception of time as an arrow has become the standard view of cosmic history, even among secularized eschatologies like those of Marxism and Ray Kurzweil's "singularitarianism," discussed later. It also fits with our contemporary understanding of cosmic evolution, whereby the universe began with a "big bang" and will eventually come to an "end" with the heat death of the universe, one of the main topics of the next chapter.

The Indestructibility of Humanity

The common theme shared by all but a few of the examples discussed above is that humanity never completely disappears. In the flood myths, two or more people always survive to repopulate the planet. The catastrophes discussed by Plato and Aristotle are localized events that, as such, enable some portion of the human population to persist. The same goes for the cyclical eschatologies of Hinduism and Buddhism, while the creation stories of the ancient Egyptians and Aztecs conclude with humanity enduring. In the linear narratives of Christianity and Islam, the culmination of world history coincides with humanity entering into the eternal afterlife with God in heaven or Satan in hell. In other words, we continue to exist, albeit with supernaturally enhanced bodies. The most interesting cases come from Xenophanes, Empedocles, and the Stoics, who posited stages of their cosmologies in which humanity does disappear entirely, but this is only ever a temporary state of affairs. Once the stage of dryness returns, on the account proposed by Xenophanes, our species always reemerges. Hence, even though humanity undergoes a certain type of extinction—which I will later call "demographic extinction"—we are nonetheless indestructible.

This notion of indestructibility is what underlies the overwhelming majority of ancient tales of past and future catastrophes, eschatologies involving global disasters at the end of time, and cosmic cycles that reduce humanity to only a few individuals or none at all. It is the common denominator of all the accounts above, even those that imagined our complete disappearance. Indeed, it is not even clear that humanity *could have* gone extinct in stories like the Noachian flood myth, given our special place in creation as the only beings made in the image or likeness of

God. What would become of creation if humanity were to cease existing? What would be the point of God's six days of work if the beings to which he gave dominion over all other creatures were to no longer be? As numerous scholars have noted, underlying many of our conceptions of the universe throughout history has been a certain persistent anthropocentrism, according to which humanity lies at the center of everything and hence without us the world would have no purpose or meaning. It would be incomplete, a "mere wasteland" as one philosopher would later put it. Since it is inconceivable that the world would have no purpose or be rendered incomplete, the assumption of our indestructibility follows.

Exceptions to the Rule?

However, there are some possible exceptions from this period, before the rise of Christianity in the opening centuries of the first millennium. Consider a line from the *Epic of Gilgamesh* in which Enlil, after discovering Utnapishtim's boat after the flood, becomes "furious" and "filled with rage," declaring: "Where did a living being escape? No man was to survive the annihilation!" This suggests that Enlil's aim was the total eradication of humanity, which points to a stronger conception of human extinction than Xenophanes, Empedocles, and the Stoics had in mind, whereby our destruction is both complete and permanent.[20]

A more intriguing case comes from the ancient Greek atomists, who held that everything in the universe is composed of "atoms" (literally, "uncuttable" or "indivisible"). Too small to see with the naked eye, they collide with each other while moving about the void, sometimes sticking together due to hooks and barbs on their surface. All macroscopic objects are the result of different configurations of atoms: one configuration yields a tree, another the moon, and yet another the human organism.[21] Cosmologically, the atomists believed space and time to be infinite, like the number of atoms, and consequently an endless procession of worlds, or *kosmoi*, are formed through the random interaction of these particles.[22] As Hippolytus of Rome (c. 170–235) describes the idea in his *Refutation of All Heresies*, Democritus (c. 460–370), who founded the atomist school along with his teacher Leucippus, maintains that

> in some [*kosmoi*] there is neither sun nor moon, while in others that they are larger than with us, and with others more numerous. And that [some] attain their full size, while others dwindle away and that in one quarter they are coming into existence, whilst in another they are failing; and that they are destroyed by clashing one with another.[23]

On this view, the ultimate destiny of all *kosmoi* is complete dissolution. Hence, it is only a matter of time before our own world disappears and, along with it, the human race. Although I am not aware of any ancient atomists elaborating on this idea, total human extinction is a straightforward implication of their cosmological

theory. However, this theory also implies that another world exactly like ours will eventually arise somewhere within the infinite corridors of space and time. What makes this view unique is that the growth and collapse of our world is not part of a serial sequence of events—that is to say, it is not *our* particular *kosmos* that perishes and reappears but rather different *kosmoi* arising and collapsing throughout the void. Consequently, there is a sense in which the atomists' view implies that our species is *not* indestructible, since our lineage here on Earth will eventually cease to exist forever, although from a cosmic perspective, "humanity" may indeed be ineradicable, as creatures just like us will always exist.

This is the most notable example within the Western tradition, so far as I know, of a view that comes close to suggesting our destructibility. But there are also occasional references in the ancient literature to the idea of there *never having been* any humans at all, which is similar to *human extinction* in that it entails there being no tokens of the type "humanity," but different in that it is backward- rather than forward-looking. For example, consider the following passage from the second tractate in Seder Moed (of the Babylonian Talmud), titled Eruvin, in which two schools of early first-millennium-CE Jewish thought, namely, the schools of Beit Shammai and Beit Hillel, disagreed about which is better: the existence or nonexistence of humanity. To quote the passage in full:

> The Sages taught the following baraita: For two and a half years, Beit Shammai and Beit Hillel disagreed. These say: It would have been preferable had man not been created than to have been created. And those said: It is preferable for man to have been created than had he not been created. Ultimately, they were counted and concluded: It would have been preferable had man not been created than to have been created. However, now that he has been created, he should examine his actions that he has performed and seek to correct them. And some say: He should scrutinize his planned actions and evaluate whether or not and in what manner those actions should be performed, so that he will not sin.[24]

Similarly, the Book of Genesis includes a curious passage in which God, after surveying the wickedness of humanity before deciding to send a flood, says he "regretted that he had made human beings on the earth," which suggests that God wished we had never existed. We will revisit this distinction between dying out and never having been in Chapter 10.[25] For now, it is worth registering that, even if our complete disappearance might have been difficult to imagine, some did entertain the idea of a universe that never contained any humans at all.

Fishes That Have Wings

Turning from this colorful mosaic of beliefs to the roughly 1,500-year period during which naturalistic extinction in even its most minimal sense became almost universally unthinkable in the West, let's begin with what the Great Chain of

Being is, when it was first articulated, and how it collapsed during this first existential mood. We will then examine the historical origins of the ontological and eschatological theses, which took root with the rise of Christianity and persisted into the nineteenth century, at which point their decline enabled the second existential mood to emerge. Recall that these are the three beliefs that "blocked" *human extinction* beginning around the fourth and fifth centuries CE—that is, they established a particular set of reasons, unique to Christianity, for *why* humanity is indestructible—and hence understanding the nature, origins, and eventual decline of these ideas is an integral part of the narrative of Part I.

According to Arthur Lovejoy's magisterial book *The Great Chain of Being*, published in 1936, the Great Chain can be decomposed into three main ingredients: (1) the principle of plenitude, which originated with Plato and asserts that there are no unrealized possibilities in the universe. If something *can* exist, it *will* exist, meaning that the world is exhaustively "full" of every *kind of thing*. (2) The principle of continuity, which arose from Aristotle's philosophy and claims that "the qualitative differences of things must . . . constitute linear or continuous series." This gave rise to the idea that all animals can be arranged into a linear hierarchy, or a *scala naturae* ("ladder of being"), based on excellence or perfection.[26] And (3) the principle of unilinear gradation, also from Aristotle, which corresponds to the idea that "living beings are linked to one another by regularly graduated affinities" that are infinitesimally small.[27] Putting these ingredients together: if something can occupy the space between two other kinds of things, then it *will* occupy that space; there are no gaps, only a continuous sequence of minute gradations from top to bottom.[28]

However peculiar this idea may seem to us today, it was profoundly influential for more than a millennium of Western history, having been first articulated by Neoplatonists like Plotinus in the third century CE. As Lovejoy details, one finds expressions of the Great Chain in the writings of an enormous number of influential philosophers across time, as when John Locke wrote in his 1689 *Essay Concerning Human Understanding* that

> in all the visible corporeal world we see no chasms or gaps, and a continued series that in each remove differ very little one from the other. There are fishes that have wings and are not strangers to the airy region, and there are some birds that are inhabitants of the water, whose blood is as cold as fishes.

"Amphibious animals," he continued, "link the terrestrial and aquatic together . . . not to mention what is confidently reported of mermaids or sea-men."[29] Indeed, one could more or less *deduce* the existence of mermaids and sea-men from the underlying principles of the Great Chain model: if there appears to be a gap, something must fill it, so why doubt the veracity of such reports? Others identified bats as "intermediate between animals that live on the ground and animals that fly," and believed that "zoophytes" like the "Vegetable Lamb of Tartary," a plant with sheep as fruit, connect the animal and plant realms.[30]

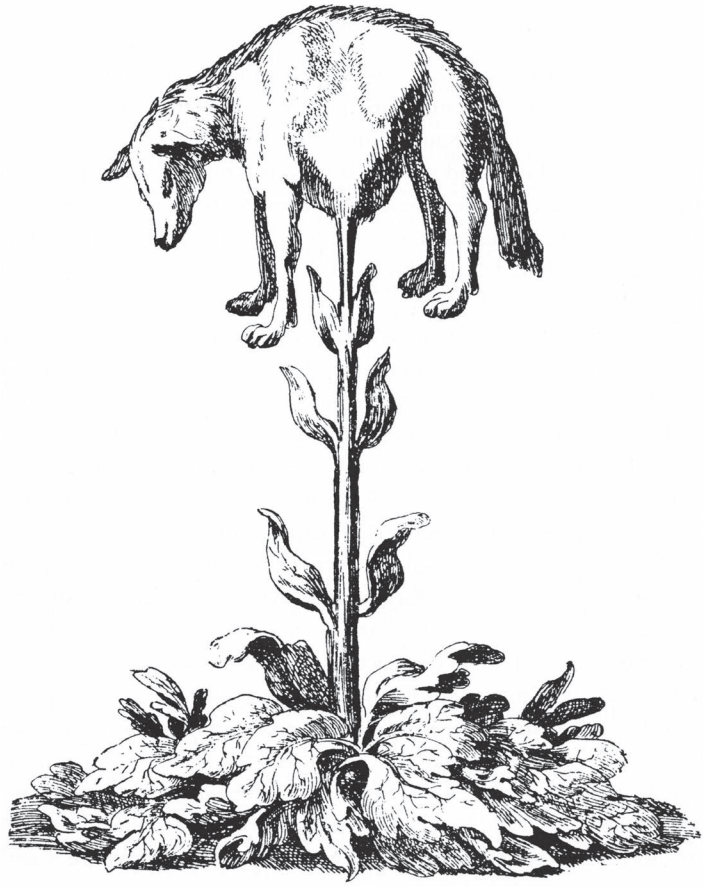

Figure 2.1 The Vegetable Lamb of Tartary, a zoophyte that some believed grew in Central Asia.

The key idea for our purposes is that because the Great Chain was taken to be an immutable and complete hierarchical ordering of everything that exists, it precluded the possibility of anything ceasing to exist *entirely*, even temporarily.[31] As the English poet Alexander Pope wrote in his enormously influential 1733/34 poem *An Essay on Man*:[32]

> Vast chain of being! which from God began,
> Natures aethereal, human, angel, man,
> Beast, bird, fish, insect, what no eye can see,
> No glass can reach; from Infinite to thee,

> From thee to nothing.—On superior pow'rs
> Were we to press, inferior might on ours;
> Or in the full creation leave a void,
> Where, one step broken, the great scale's destroy'd;
> From Nature's chain whatever link you strike,
> Tenth or ten thousandth, breaks the chain alike.

Notice the eighth line: "Where, one step broken, the great scale's destroy'd," which means that if even a single link were to go missing, the entire Great Chain would collapse. We can reconstruct the reasoning behind this as follows:

(p1) The completeness and immutability of the Great Chain testifies to God's absolute perfection.
(p2) The loss of any link in the chain would destroy the system, since it would no longer be complete and immutable.
(p3) If the system were destroyed, then God wouldn't be perfect.[33]
(p4) But God *is* perfect.
(c) Therefore, links cannot be lost.

In other words, broken chains are *metaphysically* impossible, and hence so is extinction.[34]

A Mammoth Discovery

The Great Chain dominated Western thought about the fundamental structure of reality from the Middle Ages to the early nineteenth century, although we will see in a later chapter that it evolved over time. Yet the implication that extinction is impossible was increasingly at odds with a growing collection of fossilized bones that did not match any known living creatures. People had been aware of fossils for millennia, of course: they jut out of cliffs, wash up on beaches, and are sometimes exposed by heavy rains. As the folklorist Adrienne Mayor observes, "the ancients collected, measured, displayed, and pondered the bones of extinct beasts, and they recorded their discoveries and imaginative interpretations of the fossil remains in numerous writings that survive today."[35] In fact, Xenophanes's cyclical cosmology of wetness/dryness was partly inspired by fossilized marine organisms found on Malta (a Mediterranean island south of Italy), which led him to infer that it was once submerged under water.[36] Some anthropologists have even argued that fossils may have been "prized possessions" among Neanderthals, as they have been uncovered alongside artifacts created by these Pleistocene-epoch humans.

But a number of fossil discoveries in North America, Siberia, and elsewhere during the eighteenth century added urgency to the question of extinction.[37] To preserve the integrity of the Great Chain, Christian naturalists proposed a range of imaginative hypotheses to explain away these peculiar formations. Some

argued they were remnants of the Noachian flood, while others suggested that they mysteriously fell from the sky. The Welsh polymath Edward Lhuyd, in 1713, proposed that they had "originated from seeds that somehow grew within the rocks and thus mimicked living structures," while John Ray conjectured that they belong to species still alive in unknown regions of the world.[38] The latter view was accepted by the scientifically minded Thomas Jefferson, who believed that mastodon bones unearthed in North America belong to creatures still roaming parts of the continent, references to which are found in "the traditionary testimony of the Indians."[39] To prove this true, he instructed Meriwether Lewis and William Clark to collect evidence of the mastodon during their expedition to the Pacific Coast, writing to them in 1803: "Other objects worthy of notice will be . . . the remains & accounts of any which may be deemed rare or extinct."[40]

A few people prior to the nineteenth century did accept the reality of extinction. For example, according to Mayor, the Roman poet Lucretius (c. 99–55 BCE) "provided the clearest expression of extinction and 'survival of the fittest' in ancient literature," as when he wrote in *On the Nature of Things* that certain species incapable of protecting themselves have died out.[41] "It was open season on those brutes," he wrote, "Until Nature finally drove their species to extinction."[42] Seventeen centuries later, Robert Hooke—dubbed the "English Leonardo da Vinci"—claimed in a posthumously published treatise that "diverse Species of things" in the past have been "wholly destroyed and annihilated," citing the Platonic legend of Atlantis as evidence of violent earthquakes causing entire islands to disappear.[43] Others at the time, while rejecting the idea that extinctions can occur naturally, began warming to the idea that this might be possible if *caused by humans*, as this was seen as compatible with God having created a flawless natural order.[44] The problem was not God but human action enabled by free will, which has corrupted this order by knocking out steps in an otherwise infrangible hierarchy. Still others, such as the French Enlightenment *philosophe* Denis Diderot—once a theist, deist, pantheist, and eventually an atheist—argued in 1769 that species, including humanity, can indeed go extinct.[45] But, channeling the principle of plenitude, he immediately added that "the whole cycle of life [would begin] anew," including "man, but not as he is. First, a certain something; then another certain something; and then, after several hundreds of millions of years and so many more certain somethings, the bipedal animal who has the name of man."[46] On the whole, though, the notion that species could go extinct was widely dismissed or rejected, with rare exceptions like these.

This situation changed dramatically following the groundbreaking late-century work of Georges Cuvier, a French zoologist who was considered to be among the greatest minds of his generation (now known as the "Founding Father of Paleontology"). In a 1796 lecture, Cuvier presented research demonstrating beyond a reasonable doubt that elephantine bones found in North America and Siberia belong to species no longer present: the mammoth and mastodon, the latter of which he named in 1817. By 1800, he had identified twenty-three species

that apparently went extinct, from which he extrapolated that many more must be buried in the stratigraphic graveyard of Earth, yet to be discovered.[47] Twelve years later, he proposed a novel classificatory system that organized the animal kingdom into four fundamentally different types, or *embranchements*, thus further breaking the linear Chain of Being, as Cuvier's system organized species based on "similarities in their internal structure, not on an ordered ranking of their external characters."[48] Although remnants of the Great Chain persisted for several decades, Cuvier more or less single-handedly established that extinction is a genuine feature of biological history, something that has occurred naturally, perhaps many times, and in doing so he dealt an immense blow to the Great Chain and its underlying principle of plenitude.[49] By the 1830s, then, the scientific community had largely come to agree with Cuvier that the Great Chain no longer represents the fundamental structure of reality, a momentous shift that cleared away one hurdle to imagining our own extinction.[50]

Origins of the Other Cluster of Beliefs

However, the dissolution of the Great Chain did not render *human extinction* conceivable, as the ontological and eschatological theses still implied that, even if other species can go extinct, our species cannot, since we are immortal beings who play a central role in God's grand plan for the cosmos. In other words, our place is unique within God's creation: we are different from all other creatures in kind rather than degree, and this fact ensures that our own extinction remains impossible.

But where did the ontological and eschatological theses come from? How did they develop? We have already touched upon the origins of the eschatological thesis: the narrative of Christian eschatology may have been inherited from the ancient Persians—in particular, from Zoroastrianism, which the Jewish people would have encountered during the Babylonian Exile. This narrative was then transferred to Christianity (and Islam), although theologians have given it many different interpretations over the centuries; for example, Augustine espoused an "amillennialist" eschatology, while many contemporary Christians embrace a "premillennialist" view, discussed more in Chapter 4. As for the ontological thesis, the notion of soul immortality was not originally part of the emerging Christian faith at the start of the first millennium. The early authors of the New Testament held a view closer to physicalism (or materialism) than dualism, following the earlier Hebraic tradition, which said little about the nature of persons or the question of personal eschatology. The conception of human beings as spiritually immortal came from Platonic philosophy, and was incorporated into Christianity as the faith spread across the Mediterranean region. By the fourth century, this Platonic idea had become fairly well established among Christians, as exemplified by the theological writings of Saint Augustine, who was expressly influenced by the "books of the Platonists," a reference to the Neoplatonists.[51]

One of the defining features of Neoplatonism was a belief in the immortality of the soul.

As for the rise of Christianity itself, Keith Hopkins writes that "the greatest surge in Christian numbers (in absolute terms) occurred in two stages, in the third century and fourth centuries" of the Common Era,[52] although it was during the fifth (or at least sixth) century that Christianity became widely accepted by citizens of the Roman Empire, following two significant developments: (a) the Edict of Milan in 313, issued by Constantine and Licinius, which decriminalized Christianity and many other religions, and (b) the Edict of Thessalonica in 380, issued by Theodosius I, Gratian, and Valentinian II, which made Nicene (Catholic) Christianity the "state religion" of the Roman Empire (though the term "state religion" is misleading, as there was no separation of church and state). Once established, Christianity dominated the Western tradition until the nineteenth century, when three major developments in particular caused atheism to spread among the educated classes, or intelligentsia. Religious belief then declined precipitously among the general public starting in the 1960s, which marked the beginning of the "Age of Atheism," and this Western trend of secularization continues up to now, with one study projecting that religion is racing toward "extinction" (their word) in nine Western countries.[53] We will return to these issues in the next two chapters.

Let's pause for a moment on the implications of this picture. If correct, it means that two historical figures may have been disproportionately responsible for the idea of *human extinction* being occluded from view for a large chunk of Western history. On the one hand, Plato introduced the principle of plenitude and established the doctrine of soul immortality through his influential writings, which thus gave rise to two reasons that naturalistic human extinction is impossible: (a) because extinction of *any sort* is impossible (principle of plenitude) and (b) because *our* extinction could never happen given the immortality of our souls. On the other hand, if the eschatological narrative of Christianity can be traced back to Zoroastrianism, then one could argue that Zoroaster, its founder, was responsible for outlining a vision of the future that would eventually give rise to the eschatological thesis. Hence, one can make a case that the philosophical and religious legacies of these two individuals shaped the history of thinking about our extinction in crucial and profound ways, as they introduced ideas that later became central to the Christian worldview, thus blocking the idea for some 1,500 years. This is a remarkable fact, although it is of course possible that such ideas would have arisen anyway, being invented by others.

Whereas the Great Chain collapsed in the early nineteenth century, it wasn't until later that century that the ontological and eschatological theses significantly declined in influence among the intelligentsia, as alluded to above. Since this occurred mostly during the second existential mood, we will save it for the next chapter. However, we should note that due to the rise of deism during the

Enlightenment, the eschatological thesis lost some of its force even before the nineteenth century arrived. Deists generally reject special revelation, and since biblical prophecies are based on special revelation, many deists rejected aspects of Christian eschatology. This nudged aside one barrier to taking seriously the idea of naturalistic extinction, although many in the eighteenth century—"the century of philosophy *par excellence*," as D'Alembert famously declared—still held that we are spiritually immortal, and were also influenced by the Great Chain model of reality and its principle of plenitude, an example being Diderot's speculation above. The more definitive blow to the eschatological thesis happened when Christianity as a whole became seen by many, in the latter nineteenth century, as untenable.

Catastrophism, Population Decline, and the Life Cycle of Species

Before concluding this chapter, it is worth registering a number of important developments toward the end of the first existential mood, some of which anticipated ideas and discoveries that became central to subsequent moods. First, the eighteenth and early nineteenth centuries witnessed many new thoughts about how natural phenomena (a) could devastate large portions of the globe and (b) potentially reduce the human population to zero, although none of these proposed "kill mechanisms" became widely accepted by contemporaries at the time. Second, often linked to this, a small handful of writers—typically deists, atheists, or those with nontraditional religious beliefs—began to take seriously the *possibility* of our permanent extinction, to imagine the world bereft of human beings forever. After surveying some examples of each, we will then explore how the dominant religious worldview led the overwhelming majority of people at the time to the conclusion that, even if natural catastrophes could devastate the planet, we can rest assured that humanity is safe—because we are, at bottom, indestructible.

Let's begin with the theory of *catastrophism*, which explained geological features of Earth as the result of large-scale, sudden catastrophes that had periodically taken place in the past. The theory's most influential exponent was, in fact, Cuvier, who referred to such catastrophes as *révolutions* and identified them with huge floods that caused mass extinctions. Of note is that Cuvier did not associate any of these floods with the biblical deluge: *révolutions* were wholly natural, a point we will return to in Chapter 5.[54] Even earlier, in the eighteenth century, the French Enlightenment philosopher Montesquieu pointed to various secular phenomena that, he argued, are responsible for the human population dwindling over time, until there are no more people left. This was presented in his 1721 epistolary novel *Persian Letters*, which consists of fictional missives written primarily by two Persian noblemen, Usbek and Rica, while visiting France. (By examining France through the eyes of a foreigner, Montesquieu hoped to enable readers

to see their culture from a novel perspective.) In a letter to Usbek from his friend Rhedi, the latter reports that

> there are upon the earth hardly one tenth part of the people which there were in ancient times. And the astonishing thing is, that the depopulation goes on daily: if it continues, in ten centuries the earth will be a desert. Here, my dear Usbek, you have the most terrible calamity that can ever happen in the world. But we have scarcely perceived it, because it has stolen upon us gradually in the course of a great many centuries, which denotes an inward defect, a secret and hidden poison, a malady of declining, afflicting human nature.

Usbek, whose views seem most closely aligned with Montesquieu's own, wrote back to Rhedi that there have been "catastrophes, so common in history, which have destroyed whole cities and kingdoms: there are general ones which many a time have brought the human race next door to destruction." This includes, he says, floods like the one that reduced humanity to a single family—Noah's family—as well as "universal plagues which have one after the other desolated the earth." In some cases, "one degree more of corruption would have destroyed, perhaps in a single day, the whole human race." He further identified famine—"the earth tired out with providing subsistence for men"—as another possible threat, noting that not "all destructions have . . . been violent." However, Usbek speculates that the *actual* cause of the decline noted by Rhedi is the result of cultural practices common among Christians and Muslims that lead to people having fewer children. This is why "the earth is less populous than it was formerly."[55] Here we have, essentially, a causal explanation of how humanity could disappear that is cultural in nature. As David Young notes, "Montesquieu's investigation was meant as a serious population study," and this is how contemporaries read it: the total number of people on Earth is decreasing, and if this trend continues, the total number could eventually equal zero.[56]

A few decades later, David Hume penned a refutation of Montesquieu's depopulation thesis in which he contended that Montesquieu had uncritically accepted an exaggerated estimate of how large the human population was in the ancient world. There was not, in fact, a much larger population in the past than at present. Notably, though, Hume also conjectured that the human species may have a "life cycle" just like those of its members. "There is very little ground, either from reason or observation, to conclude the world eternal or incorruptible," he wrote. To the contrary, the evidence strongly suggests "the mortality of this fabric of the world, and its passage, by corruption or dissolution, from one state or order to another." Consequently, he concluded that the universe "must therefore, as well as each individual form which it contains, have its infancy, youth, manhood, and old age; and it is probable, that, in all these variations, man, equally with every animal and vegetable, will partake."[57] In other words, both the universe and our species may be subject to the same trajectories of growth and decline that characterize

our individual lives. This idea—that species have life cycles just like individual organisms—has been made on numerous occasions throughout history. Indeed, one year after Hume's book, Diderot echoed it in conjecturing that "in the animal and vegetable kingdoms, an individual begins, so to speak, increases, lasts, withers and passes away; would it not be the same for whole species?"[58] Hence, the causal mechanism arises from the fact that species are *naturally mortal* no less than individuals, a theory of so-called "intrinsic" extinction that some naturalists embraced the following century.[59]

The First Last Men

Another population-decline scenario was depicted in Jean-Baptiste Cousin de Grainville's 1805 novel *Le Dernier homme*, or *The Last Man*. Published posthumously after de Grainville, who suffered from a desperate case of loneliness, committed suicide by leaping into the Canal de la Somme at two in the morning, the novel follows the peripatetic journey of Omegarus, who boards an airship to Brazil in search of the only remaining fertile woman on Earth, Syderia. Of note is that this infertility is natural in origin and hence some scholars have argued that *Le Dernier homme* "extrapolates perhaps the earliest images of a secular apocalypse," although de Grainville ultimately grounded his story "in the Biblical narratives of Genesis and the Apocalypse told in St. John's Revelations."[60] In fact, prior to this decline in fertility, the story describes another secular scenario in which human overexploitation of natural resources destroys the environment, an idea that may have been inspired by the population theory of Thomas Malthus, which has left an indelible mark on the Western imagination since its introduction in 1798. According to Malthus, the supply of food grows at an arithmetic rate, whereas the human population increases at a geometric rate, which thus leads to an inevitable collapse of the population. However, Malthus himself did not identify the outcome as extinction but instead predicted a "perpetual oscillation between happiness and misery"—yet another example of the Ouroboros motif.

This theory sparked significant debate at the time, as it was widely assumed up to and throughout the Enlightenment that, as Montesquieu had believed, the ancient world was far more populous than the contemporary world.[61] In a polemical response to Malthus published in 1820, for example, William Godwin contended that "war, pestilence, and famine" threaten catastrophic decreases in the human population, and hence that

> for any thing [*sic*] that appears from the enumerations and documents hitherto collected, it may be one of the first duties incumbent on the true statesman and friend of human kind, to prevent that diminution in the numbers of his fellow-men, which has been thought, by some of the profoundest enquirers [a reference to Montesquieu], ultimately to threaten the extinction of our species.[62]

It could, of course, be the case that war, pestilence, and famine are the *result* of a Malthusian catastrophe, and that this could lead not just to misery but our extinction—an idea vigorously promoted by some leading environmentalists in the twentieth century. But this was not Godwin's view, nor was it explored by de Grainville in his tragic novel about the last couple on Earth, Omegarus and Syderia.

As it happens, de Grainville's novel inaugurated a literary genre known as the "Last Man," which became immensely popular in the early nineteenth century, inspiring a large number of poems, paintings, short stories, and novels. The most well-known example, at least since the 1960s, is Mary Shelley's 1826 *The Last Man*, which was probably influenced by an anonymous English translation of de Grainville's story. In Shelley's telling, though, the human population collapses over a few years due to a worldwide plague transmitted (non-contagiously) through miasma.[63] While the autodiegetic narration of Lionel Verney, the dystopian story's main character, does not explicitly end with the complete disappearance of humanity—after all, extinction precludes the possibility of any narrator noting this fact, a point made by some early critics of the genre—Shelley strongly implied that when Verney dies, so too does the human species. Unlike de Grainville, Shelley did not embed her tale within a larger religio-apocalyptic narrative in which humanity ultimately "survives" the global pandemic. That is to say, not only did she specify a naturalistic *etiology* of extinction, but she gestured at a naturalistic *outcome*, whereby the human story simply comes to an end, without this initiating a new beginning.[64]

Conversations About Comets

A more commonly discussed natural catastrophe scenario in the eighteenth and nineteenth centuries involved comets. In contrast to asteroids—derogatorily dubbed the "vermin of the sky"—humans have known about these shimmering objects for millennia, as indicated by observations recorded on ancient Chinese oracle bones used by diviners who practiced pyromancy. Often considered to be "omens and bearers of bad news," comets have also triggered occasional fears that they could collide with Earth; as Duncan Steel writes, "the possibility of catastrophic impact by comets resurfaced from time to time before the modern era."[65] For example, in *Conversations of Lord Byron* (1824), the English poet Thomas Medwin recounts a conversation with Byron in which he pondered: "Do you imagine that, in former stages of this planet, wiser creatures than ourselves did not exist?," which he found plausible given that "we are at present in the infancy of science." These past creatures, Byron suggested, had been wiped out by comets colliding with Earth, leading him to worry that humanity could suffer the same violent fate. In perhaps the very first reference to a "planetary defense system" to protect Earth from these heavenly assassins, Byron declared:

> Who knows whether, when a comet shall approach this globe to destroy it, as it often has been and will be destroyed, men will not tear rocks from their

> foundations by means of steam, and hurl mountains, as the giants are said to have done, against the flaming mass.[66]

In other words, an annihilatory collision is all but guaranteed unless humanity uses the "power of steam" to catapult mountain-sized heaps of rocks at the incoming comet. Of note is that Byron was also among the very first of this late period to depict, in his 1816 poem *Darkness*, a world completely bereft of humanity. Unlike Shelley, a close friend of his, Byron did not specify a cause of our extinction, but he did paint an eerie, ominous picture of Earth having become "seasonless, herbless, treeless, manless, lifeless/A lump of death—a chaos of hard clay." However, the impetus of this poem wasn't so much to foreground the *possibility* of extinction but to make a rather unrelated point about the *nature* of human beings, using the extreme scenario of our collective non-existence as a way of undermining Enlightenment views of humanity (a point elaborated in Chapter 8). Still, Byron's speculations and poetic imaginings—followed by Shelley's 1826 novel—mark an important moment in intellectual history: after roughly 1,500 years of the idea being completely blocked from view, some in the Western tradition, toward the end of this first existential mood, were beginning to see *human extinction* as an intelligible possibility.

Other natural catastrophe scenarios proposed at the time involved astrophysical phenomena of a different sort. For example, Comte de Buffon hypothesized that Earth was created when a comet slammed into the sun and threw off a giant fragment.[67] Initially in a molten state, Earth has cooled over the course of some 75,000 years.[68] Buffon thus likened our planet to a "dying ember of the sun" that will become increasingly inhospitable due to "its gradual refrigeration, a reign of perpetual winter."[69] Even earlier, Bernard Le Bovier de Fontenelle discussed the possibility of sun spots forming a crust over the sun in his *Conversations on the Plurality of Worlds*, published in 1686.[70] He noted that "the ancients saw fixed stars in the sky which we no longer see," which he took as evidence that our sun could also stop shining.[71] This idea was popularized the following century by an anonymous Italian astronomer who predicted that on July 18, 1816, our sun would extinguish itself, which seemed to be corroborated by sunspots that became increasingly visible, not just telescopically but to the naked eye, and the peculiar weather of 1816 that led it to be dubbed the "Year Without a Summer" (the result of, unbeknownst to those at the time, the "super-colossal" eruption of Mount Tambora in Indonesia in 1815). This was called the Bologna prophecy.

A fascinating inventory of such doomsday speculations comes from a short article published on October 1, 1816, in *The New Monthly Magazine*. Written by an anonymous author going by "H" and titled "Of the End of the World," its explicit aim is "to stop the mouths of all who may be disposed to make light of so serious a subject," namely, the destruction of humanity. As the author opens the article, referring to the failed Bologna prophecy, "because the world was not destroyed on the 18th of July, we imagine that it will never be at an end, and

laugh as if we had never been afraid." The author proceeds to outline Buffon's scenario, whereby "the globe is growing colder every day." He further notes that sunspots are, according to some, "scoria adhering to the surface of the luminary," and that a comet collision should be expected "in three or four thousand years at latest." Additional scenarios include the moon someday crashing to Earth and the earth falling into the sun. Before this happens, though, H claims that our planet is drying up and the oceans sinking. As it becomes increasingly desiccated, it will eventually catch fire, and "the generation now living, we shall all be burned, and our funeral pile will be kindled when there is no more water upon the earth—a consideration which ought to make us tremble now that water is become [*sic*] so scarce." "Here, then, is a very rational *end of the world!*," they write. Yet, in a passage that parallels Diderot's plenitude-based prediction above, the author argues that Earth will once again contain water, and out of these organic molecules (or "zoophytes," H states) will evolve into lobsters, lobsters into "tatoos" (i.e., armadillos), tatoos into apes, and eventually apes into men "who, after some more billions of centuries, will build cities, compose operas, and invent cosmogonies."[72] In other words, our disappearance would not be permanent.

Yankee Professors

As this brief survey shows, people throughout the eighteenth and early nineteenth centuries proposed an impressive range of creative ideas about how the world could end and/or humanity be destroyed. But recall from Chapter 1 that "kill mechanism" refers to a way that the collective whole of humanity could disappear based on established scientific principles (theories, laws, mechanisms) rather than idiosyncratic speculations or religio-philosophical belief systems. Prior to the mid-nineteenth century, none of the doomsday scenarios conjured up by people involved causal phenomena that were widely seen as posing genuine risks to humanity. In many cases, the destruction of the world was specifically tied to biblical prophecy and hence did not entail humanity dying out in the naturalistic sense; for this reason, they did not count as kill mechanisms. In other cases, there was just no particularly compelling reason to believe that the associated kill mechanisms could *actually* kill us off. An example of this comes from Edgar Allan Poe's 1839 short story "The Conversation of Eiros and Charmion," in which humanity perishes due to an "irresistible, all-devouring, omni-prevalent, immediate" conflagration caused by a comet passing by Earth. The comet extracts nitrogen from our atmosphere, leaving behind high concentrations of the combustible element oxygen, which subsequently ignites as "the nucleus of the destroyer" causes "a wild lurid light alone, visiting and penetrating all things." While this story earns points for creativity, no one was worried that this might actually happen. Furthermore, Poe linked the catastrophe to "the fiery and horror-inspiring denunciations of the prophecies of the Holy Book," and indeed the story involves a conversation between two people, Eiros and Charmion, in the afterlife.[73]